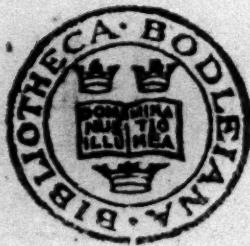


EXPERIMENTS,
AND
NOTES,
About
The Mechanical Origine
AND
PRODUCTION
OF
VOLATILITY.

By the Honourable
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EXPERIMENTS,
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CHAP. I.

AS far as I have yet observed, the Qualifications or Attributes, on whose account a portion of matter is found to be *Volatile*, are chiefly four; whereof the three former most regard the single Corpuscles

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as such ; and the last, the manner of their Union in the aggregate or body they make up.

But before I enter upon particulars, give me leave to advertise you here once for all, That in the following Notes about *Volatility* and *Fixt-ness*, when I speak of the Corpuscles or minute parts of a body, I doe not mean strictly either the Elementary parts, such as Earth and Water, or the Hypostatical Principles, such as Salt, Sulphur, or Mercury ; for these things come not here into consideration : But onely such Corpuscles, whether of a simple, compounded or decomposed Nature, as have the particles they consist of so firmly united, that they will not be totally disjoyned or dissipated by that degree of Fire or Heat, wherein the matter is said to be volatile or to be fixt. But these combined particles will in their aggregate either ascend, or continue unraised *per modum Unius* (as they speak) or as one intire Corpuscle. As in a Corpuscle of Sal Armoniac,

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niac, whether it be a natural or factitious thing, or whether it be perfectly similar, or compounded of differing parts, I look upon the intire Corpuscle as a volatile portion of matter; and so I doe on a Corpuscle of Sulphur, though experience shews when 'tis kindled, that it has great store of acid Salt in it, but which is not extricated by bare sublimation: And so Colcothar of Vitriol falls under our consideration as a fixt body, without inquiring what cupreous or other mineral and not totally fixt parts may be united with the Earthly ones; since the fires, we expose it to, do not separate them:

And this being premised in the general, I now proceed to some particulars. And first to make a volatile body, the parts should be very small. For, *cæteris paribus*, those that are so, are more easily put into motion by the action of the fire and other Agents, and consequently more apt to be elevated, when, by the determination of the movent, the situation

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of the neighbouring bodies, or other Mechanical Circumstances, the agitated Corpuscles can continue their motion with less resistance upwards than any other way, (as either downwards or horizontally.) And if, as 'tis highly probable, that which in light bodies, or at least in most of them, is wont to pass for *positive* Levity, be but a less degree of gravity than that of those contiguous bodies that raise them; it will happen, that in very many cases, (for I say not in all) the great proportion of the surface of a Corpuscle to its bulk, (which is usually greater in the lesser particles) by making it more apt to be wrought on, either by the air agitated by the fire, or by the *effluvia* of kindled fuell, or by the impulse of the shaken Corpuscles of the body it self, will much facilitate the elevation of such a minute particle, by exposing a greater portion of it to the action of the agent, as it will oftentimes also facilitate the renewed sustentation of such a small body in the air,

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air, which resists more the descent of particles whose surfaces are large, than of others of the same gravity and bulk : As a leaf of paper displayed will much longer hover in the Air, than if it were reduced into a ball or pellet. That this minuteness of particles may dispose them to be carried upwards, by the impulse of other bodies and that of the agitated Air, is very obvious to be observed : As we see, that Horses in a high-way, though they be not able with the strokes of their feet to make stones, or gravel, or clods of Earth fly up, yet they will easily raise clouds of dust oftentimes mingled with the smaller grains of sand. And where Timber is sawing, the same wind that will not in the least move the beams, and scarce at all move the chips, will easily carry up the Saw-dust into the Air. And we see in our Chimneys, that the smoak readily ascends, whilst even small clods of soot, which is but an aggregate of the particles of smoak, fall headlong down.

CHAP. II.

THE next qualification requisite in the corpuscles of Volatile bodies is, that they be not too solid or heavy. For if they be so, though their bulk be very small, yet, unless other Circumstances do much compensate their weight, 'twill be very difficult to elevate them, because of the great disproportion of their specific gravity *to* that of the Air, (which contributes to sustain and even raise many sorts of volatile parts) and *to* the strength of the igneous effluvia or other agents that would carry them up. Thus we see, that filings of Lead or Iron, and even Minium (which is the calx of Lead) though the grains they consist of be very small, will not easily be blown up like common dust, or meal, or other powders made of less ponderous materials.

A third Qualification to be desired in the corpuscles that should make
up

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up a Volatile body is, that they be conveniently shaped for motion. For if they be of branched, hook'd, or other very irregular or inconvenient figures, they will be apt to be stopt and detained by other bodies, or entangled among themselves, and consequently very difficult to be carried upwards; in regard that, whilst they are thus fastened either to one another, or to any stable body, each single Corpuscle is not onely to be considered, as having its own peculiar bulk, since its cohesion with the other corpuscle or body that detains it, makes them fit to be look'd upon *per modum Unius*; that degree of heat they are exposed to being presumed incapable of disjoyning them. And this may be one Reason, why Water, though it be specifically heavier than Oil, yet is much more easily brought to exhale in the form of vapours than is Oil, whose corpuscles by the lasting stains they leave on cloath, wood, wool, &c. (which water will but transiently moisten, not stain)

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stain) seems to be of very intangling
figures.

The fourth and last qualification requisite in a Volatile body is, that the parts do loosely adhere, or at least be united in such a manner, as does not much indispose them to be separated by the fire in the form of fumes or vapours.

For he that considers the matter, will easily grant, that, if the texture of the corpuscles, whereof a body consists, be intricate, or their cohesion strong, their mutual implication, or their adherence to each other, will make one part hinder another from flying separately away, and their conjunction will make them too heavy or unweildy to be elevated together, as intire though compounded parts. Thus we see, that in Spring, or the beginning of Summer, a wind, though not faint, is unable to carry off the lightest leaves of trees, because they stick fast to the bows and twigs on which they grow, but in Autumn, when that adhesion ceases,
and

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and the leaves sit but loosely on, a wind no stronger than that they resisted before, will with ease blow them off, and perhaps carry them up a good way into the Air. But here note, that it was not without some cause, that I added above, that in a fluid body, the parts should at least be united in such a manner, as does not much indispose them to be separated. For 'tis not impossible, that the parts of a body may, by the figures and smoothness of the surfaces, be sufficiently apt to be put into motion, and yet be indisposed to admit such a motion as would totally separate them and make them fly up into the Air. As, if you take two pieces of very flat and well-polished marble or glass, and lay them one upon the other, you easily make them slide along each others surfaces, but not easily pull up one of them, whilst the other continues its station. And when Glass is in the state of fusion, the parts of it will easily slide along each other, (as is usual in those of o-
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ther fluids) and consequently change
places, and yet the continuity of
the whole is not intirely broken, but
every corpuscle does somewhere
touch some other corpuscle, and
thereby maintain the cohesion that
indisposes it for that intire separation
accompanied with a motion upwards
that we call avolation. And so,
when Salt-peter alone, is in a Cruci-
ble exposed to the fire, though a ve-
ry moderate degree of it will suffice
to bring the Salt to a state of fusion,
and consequently to put the corpu-
sles that compose it into a restless
motion; yet a greater degree of heat,
than is necessary to melt it, will not
extricate so much as the Spirits, and
make them fly away.

CHAP. III.

TH E foregoing Doctrine of the
Volatility of bodies may be
as well illustrated as applied, if we
proceed to deduce from it the gene-
rall

rall ways of Volatilization of bodies, or of introducing volatility into an assigned portion of matter. For these wayes seem not inconveniently reducible to five, which I shall severally mention, though Nature and Art do usually imploy two or more of them in conjunction. For which Reason I would not, when I speak of one of these wayes, be understood as if, excluding the rest, I meant that no other concurred with it.

The first of the five ways or means of Volatilizing a body is, to reduce it into minute parts, and, *cæteris paribus*, the more minute they are the better.

That the bringing a body into very minute parts may much conduce to the volatilizing of it, may be gathered from the vulgar practice of the Chymists, who when they would sublime or distill Antimony, Sal Armoniac, Sea-salt, Nitre, &c. are wont to beat them to powders to facilitate their receiving a further comminution by the action of the fire.

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And here I observe, that in some bodies this comminution ought not to be made onely at first, but to be continued afterwards. For Chymists find by experience, though perhaps without considering the reason of it, that Sea-salt and Nitre, will very hardly afford their Spirits in Distillations, without they be mingled with powdered clay or bole, or some such other additament, which usually twice or thrice exceeds the weight of the Salt it self: Although these additaments, being themselves fixt, seem unlikely to promote the volatilization of the bodies mixt with them, yet by hindering the small grains of Salt to melt together into one lump or masse, and consequently by keeping them in the state of Comminution, they much conduce to the driving up of the Spirits or the finer parts of the Salts by the operation of the fire.

But to prosecute a little what I was saying of the Conduciveness of bringing a body into small parts to
the

and Production of Volatility. 15
the volatilization of it, I shall add,
that in some cases the Comminution
may be much promoted by employ-
ing Physical, after Mechanical, ways;
and that, when the parts are brought
to such a pitch of exiguity, they may
be elevated much better than before.
Thus, if you take filings of *Mars*, and
mix them with *Sal Armoniack*, some
few parts may be sublimed; but if,
as I have done, you dissolve those fi-
lings in good Spirit of Salt instead of
Oil of Vitriol, and having coagula-
ted the solution, you calcine the gree-
nish Crytalls or *vitriolum Martis* that
will be afforded, you may with ease,
and in no long time, obtain a *Crocus*
Martis of very fine parts; so that I
remember, when we exquisitely min-
gled this very fixt powder with a
convenient proportion of *Sal Armo-*
niac, and gradually press'd it with a
competent fire, we were able to ele-
vate at the first Sublimation a consi-
derable part of it; and adding a like,
or somewhat inferiour, proportion of
fresh *Sal Armoniac* to the *Caput Mor-*
tuum,

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tuum, we could raise so considerable a part of that also, and in it of the *Crocus*, that we thought, if we had had Conveniency to pursue the operation, we should, by not many repeated Sublimations, have elevated the whole *Crocus*, which (to hint that upon the by,) afforded a Sublimat of so very astringent a Tast, as may make the trial of it in stanching of blood, stopping of fluxes, and other cases, where potent astriction is desired, worthy of a Physicians Curiosity.

CHAP. IV.

TH E second means to volatilize bodies is, to rub, grind, or otherwise reduce their corpuscles to be either smooth, or otherwise fitly shaped to clear themselves, or be disintangled from each other.

By reason of the minuteness of the corpuscles, which keeps them from being separately discernible by the
 Eye,

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Eye, 'tis not to be expected, that immediate and ocular Instances should be given on this occasion; but that such a change is to be admitted in the small parts of many bodies, brought to be volatile, seems highly probable from the account formerly given of the requisites or conditions of Volatility, whose introduction into a portion of matter will scarce be explicated without the intervention of such a change. To this second Instrument of Volatilization, in concurrence with the first, may probably be referred the following Phænomena: In the two first of which there is employed no additional volatile Ingredient; and in the fourth, a fixt body is disposed to volatility by the operation of a Liqueur, though this be carefully abstracted from it.

1. If Urine freshly made be put to distill, the Phlegm will first ascend, and the Volatile salt will not rise till that be almost totally driven away, and then requires a not inconsiderable degree of fire to elevate it. But,
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if you putrefie or digest Urine, though in a well-closed Glass-Vessel, for seven or eight weeks, that gentle warmth will make the small parts so rub against, or otherwise act upon, one another, that the finer ones of the Salt will perhaps be made more slender and light, and however will be made to extricate themselves so far as to become volatile, and, ascending in a very gentle heat, leave the greatest part of the phlegm behind them.

2. So, if Must, or the sweet juice of Grapes, be distilled before it have been fermented, 'tis observed by Chymists, and we have tried the like in artificial Wine made of Raisins, that the phlegm, but no ardent Spirit, will ascend. But when this Liquour is reduced to Wine by fermentation, which is accompanied with a great and intestine commotion of the jussling parts, hitting and rubbing against one another, whereby some probably come to be broken, others to be variously ground and subtilized, the
more

and Production of Volatility. 19

more subtile parts of the Liqueur being extricated, or some of the parts being, by these operations, brought to be subtile, they are qualified to be raised by a very gentle heat before the phlegm, and convene into that fugitive Liqueur, that Chymists, for its activity, call Spirit of Wine. Nor is it onely in the slighter Instances afforded by Animals and Vegetables, that Volatility may be effected by the means lately mentioned: For experience hath assured me, that 'tis possible, by an artificial and long digestion, wherein the parts have leisure for frequent justlings and attritions, so to subtilize and dispose the corpuscles even of common Salt for Volatility, that we could make them ascend in a moderate fire of Sand without the help of Bole, Oil of Vitriol, or any Volatilizing additament; and, which is more considerable, the Spirit would in rising precede the Phlegm, and leave the greatest part thereof behind it.

This intestine commotion of parts

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capable

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capable of producing Volatility in the more disposed portions of a body, though it be much more easie to be found in Liquours, or in moist and soft bodies, yet I have sometimes, though rarely, met with it in dry ones. And particularly I remember, that some years ago having, for trial sake, taken Mustard-seed, which is a body pregnant with subtile parts, and caused it to be distilled *per se* in a Retort, I had, as I hoped, (without any more ado,) a great many grains of a clear and figured Volatile salt at the very first distillation: which Experiment having, for the greater security, made a second time with the like success, I mentioned it to some Lovers of Chymistry, as what I justly supposed they had not heard of. I leave it to farther Inquiry, whether, in a body so full of Spirits as Mustard-seed, the action and re-action of the parts among themselves, perhaps promoted by just degrees of fire, might not suffice to make in them a change equivalent in order to Volatilization, and

and Production of Volatility. 21

and the yielding a Volatile Salt, to that which we have observed Fermentation and Putrefaction to have made in the juice of Grapes, Urine, and some other bodies. How far the like success may be expected in other Trials, I cannot tell; especially not having by me any Notes of the events of some Attempts which that Inquiry put me upon: Onely I remember in general, that, as some trials, I made with other Seeds, and even with Aromatick ones, did not afford me any Volatile Salt; so the success of other trials made me now and then think, that some subjects of the Vegetable kingdom, whence we are wont to drive over acid Spirits, but no dry Salt, may be distilled with so luckily regulated a heat, as to afford something, though but little, of Volatile Salt; and that perhaps more bodies would be found to doe so, were they not too hastily or violently prest by the fire, whereby such saline schematisms of the desired parts of the matter are (by being dissipated or

confounded) destroyed or vitiated , as in a slow, dextrous, or fortunate way of management would come forth, not in a liquid, but a saline form. Of which Observation we may elsewhere mention some Instances, and shall before the close of this Paper name one, afforded us by crude Tartar.

3. Though Silver be one of the fixedst bodies that we know of, yet that 'tis not impossible but that, chiefly by a change of Texture, it may strangely be disposed to Volatility, I was induced to think by what I remember once happened to me. A Gentleman of my acquaintance, studious of Chymical *Arcana*, having lighted on a strange Menstruum, which he affirmed, and I had some cause to believe, not to be corrosive, he abstracted it from several metalls, (for the same Liquour would serve again and again,) and brought me the *Remainders*, with a desire that I would endeavour to reduce those of Lead and Silver into the pristine metalls

tals again, which he had in vain attempted to doe: whereupon, though I found the white Calx of Lead reducible, yet when I came to the Calx of Silver, I was not able to bring it into a body; and having at length melted some Lead in a gentle fire, to try whether I could make it swallow up the Calx, in order to a farther operation, I was not a little surprized to find, that this mild heat made the Calx of Silver presently fly away and sublime in the form of a *farina volatilis*, which whitened the neighbouring part of the Chimney, as well as the upper part of the Crucible.

4. From that which Chymists themselves tell us, I think we may draw a good Argument *ad hominem*, to prove, that Volatility depends much upon the texture and other Mechanical affections of a body. For divers of those Hermetick Philosophers (as they are called) that write of the *Elixir*, tell us, that when their Philosophick Mercury or grand Solvent, being sealed up together with a

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third or fourth part of Gold in a glass-Egg, is kept in convenient degrees of fire, the whole matter, and consequently the Gold, will, by the mutual operation of the included Substances, be so changed, that not onely 'twill circulate up and down in the glass, but, in case the digestion or decoction should be broken off at a certain inconvenient time, the Gold would be quite spoil'd, being, by the past and untimely-ended operation, made too Volatile to be reducible again into Gold: whereas, if the decoction be duly continued unto the end, not onely the Gold, but all the Philosophical Mercury or *Menstruum* will be turned into a Sulphur or powder of a wonderfully fixt nature. I know, there are several Chrysopæans, that speak much otherwise of this Operation, and tell us, that the Gold employed about it must be Philosophick Gold: But I know too, that there are divers others (and those too none of the least candid or rational) that speak of it as I have done; and That
is

is sufficient to ground an Argument on towards all those that embrace Their doctrine. And in this case 'tis considerable, that 'tis not by any superadded additament, that the most fixt body of Gold is made volatile, but the same massy matter, consisting of Gold and Philosophick Mercury, is, by the change of texture produced or occasioned by the various degrees and operations of fire upon it, brought to be first Volatile, and then extreamly fixt. And having said this in reference to one tribe of the Modern Spagyrist; to another of them, the *Helmontians*, I think I can offer a good Argument *ad hominem* from the Testimony and Experiments of the Founder of their Sect.

5. The acute *Helmont*, among other prodigious powers that he ascribes to the Alkahest, affirms, that, by abstracting it frequently enough, it would so change all tangible bodies, and consequently stones and metals, that they might be distilled over into Liquours equiponderant to

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to the respective bodies that afforded them, and having all the Qualities of Rain-water; which if they have, I need not tell you that they must be very Volatile. And I see not how those that admit the Truth of this strange Alkahestical operation, can well deny, that Volatility depends upon the Mechanical affections of matter, since it appears not, that the Alkahest does, at least in our case, work upon bodies otherwise than Mechanically. And it must be confessed, that the same material parts of a portion of corporeal substance, which, when they were associated and contexed (whether by an *Archeus*, seed, form, or what else you please,) after such a determinate manner, constituted a solid and fixt body, as a Flint or a lump of Gold; by having their Texture dissolved, and (perhaps after being subtilized) by being freed from their former implications or firm cohesions, may become the parts of a fluid body totally Volatile.

CHAP.

CHAP. V.

THE fourth means of making a body Volatile is, by associating the particles to be raised with such as are more Volatile than themselves, and of a figure fit to be fastened to them, or are at least apt, by being added to them, to make up with them corpuscles more disposed than they to Volatility. This being the grand Instrument of Volatilization, I shall spend somewhat the more time about it ; But I shall first here a little explain the last clause, (that I may not be obliged to resume it elsewhere,) by intimating, that 'tis not impossible, that the particles of an additament, though not more volatile than those of the body 'tis mixt with, and perhaps though not volatile at all, will yet conduce to volatilize the body wherewith 'tis mingled. For the particles of the additament may be of such figures, and so associated with those of the body to be elevated,

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as in this to enlarge the former pores, or produce new ones, by intercepting little cavities (for they must not be great ones) between the particles of a body to be raised, and those of the additament. For, by these and other such ways of association, the corpuscles, resulting from the combination or coalition of two or more of these differing particles, may, without becoming too big and unwieldy, become more conveniently shaped, or more light in proportion to their bulk, and so more easily buoyed up and sustained in the air, (as when the Lid of a Copper-box being put on, makes the whole box emerge and swim in water, because of the intercepted cavity, though neither of the parts of the box would doe so,) or otherwise more fitted for avolation than the particles themselves were before their being joined to those of the additament.

By two things chiefly the corpuscles of the additament may contribute to the elevation of a body. For
first,

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first, the parts of the former may be much more disposed for avolation than is necessary to their own Volatility. As when in the making of Sal Armoniac, the saline particles of Urine and of Soot are more fugitive than they need be to be themselves sublimed, and thereby are advantaged to carry up with them the more sluggish corpuscles whereof Sea-salt consists. And *next*, they may be of figures so proper to fasten them well to the body to be elevated, that the more fugitive will not be driven away or disjoyned from the more fixt by such a degree of Heat as is sufficient to raise them both together : To which effect the congruity or figuration is as well required, as the lightness or volatility of the particles of the additament. And therefore some of the fugitivest bodies that we know, as Spirit of Wine, Camphire, &c. will not volatilize many bodies which will be elevated by far less fugitive additaments ; because the corpuscles of Spirit of Wine stick
not

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not to those of the body they are mingled with, but, easily flying up themselves, leave those behind them, which they did rather barely touch than firmly adhere to : Whereas far less fugacious Liquours, if they be indowed with figures that fit them for a competently firm cohesion with the body they are mingled with, will be able to volatilize it. Of which I shall now give you some Instances in bodies that are very ponderous, or very fixt, or both.

And I shall begin with Colcothar, though it being a vitriolate *calx*, made by a lasting and vehement fire, 'tis (consequently) capable of resisting such a one. This being exquisitely ground with an equal weight of Sal Armoniac, which is it self a Salt but moderately volatile, will be in good part sublimed into those yellow Flowers, which we have elsewhere more particularly taught to prepare, under the name of *Ens primum Veneris*; in which, that many vitriolate corpuscles of the Colcothar are really ele-

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elevated, you may easily find by putting a grain or two of that reddish Substance into a strong infusion of Galls, which will thereby immediately acquire an inky colour.

Steel also, which, to deserve that name, must have endured extraordinary violences of the fire, and greater than is needfull to obtain other metalls from their Mother Earth; Steel it self, I say, being reduced to filings, and diligently ground with about an equal weight of Sal Armoniac, will, if degrees of fire be skillfully administred, (for 'tis easie to err in that point,) without any previous calcination or reduction to a *Crocus*, suffer so much of the metall to be carried up, as will give the Sal Armoniac a notable colour, and an ironish tast.

And here it will be proper to observe, for the sake of practical Chymists, that the Quantity or Proportion of the Volatile additament is to be regarded; though not so much as its Nature, yet more than it is wont
to

to be : And divers bodies, that are thought either altogether unfit for Sublimation, or at least incapable to have any considerable portion of them elevated, may be copiously enough sublimed, if a greater proportion of the additament, than we usually content our selves with, be skillfully employed. And in the newly-mentioned Instance of Filings of Steel, if, in stead of an equal weight of *Sal Armoniac*, the treble weight be taken, and the operation be duly managed, a far greater quantity of the metall may be raised, especially if fresh *Sal Armoniac* be carefully ground with the *Caput Mortuum*. And *Sal Armoniac* may perhaps be compounded with such other bodies, heavier than it self, as may qualifie it, when it is thus clogged, to elevate some congruous bodies better than it would of it self alone. And I shall venture to add this farther Advertisement, That if, besides the plenty of the additament, there be a sufficient fitness of its particles to lay hold

hold on those of the body to be wrought on, Mineral bodies, and those ponderous enough, may be employed to volatilize other heavy bodies. And I am apt to think, that almost, if not more than almost, all Metalls themselves may by copious additaments and frequent Cohobations be brought to pass through the neck of the Retort in distillation; and perhaps, if you melt them not with equal parts, but with many parts of *Regulus* of *Antimony*, and then proceed as the hints now given will direct you, you will not find cause to despise what I have been saying.

You know what endeavours have been, and are still fruitlessly, imployed by Chymists to elevate so fixt a body as *Salt of Tartar* by additaments. I shall not now speak much of the enterprize in generall, designing chiefly to tell you on this occasion, that, whereas frequent experience shews, that *Sal Armoniac* being abstracted from *Salt of Tartar*, not onely the

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Salt

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Salt of Tartar is left at the bottom, but a good part of the Sal Armoniac is left behind with it; I suspected the cause might be, that Sal Armoniac, by the operation of the Alkaly of Tartar, is reduced into Sea-salt, and Urinous or fuliginous Salt, as 'twas at first composed of those differing Ingredients; and that by this means the volatil Salt being loosened or disintangled from the rest, and being of a very fugacious Nature, flies easily away it self, without staying long enough to take up any other Salt with it. And therefore, if this *Analysis* of the Sal Armoniac could be prevented, it seemed not impossible to me, that some part of the Salt of Tartar, as well as of Colcothar and Steel, might be carried up by it: And accordingly having caused the Ingredients to be exceedingly well dryed, and both nimbly and carefully mixt, and speedily exposed to the fire, I have sometimes had a portion of Salt of Tartar carried up with the Sal Armoniac: but this happened

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peped so very rarely, that I suspected some peculiar fitness for this work in some parcels of Sal Armoniac, that are scarce but by the effect to be discerned from others. But however, what has happened to us may argue the Possibility of the thing, and may serve to shew the volatilizing efficacy of Sal Armoniac; which is a Compound, that I elsewhere recommend, and doe it now again, as one of the usefulest Productions of vulgar Chymistry.

And since I have mentioned the Volatilization of *Salt of Tartar*, presuming your Curiosity will make you desire my Opinion about the Possibility of it, I shall propose to you a distinction, that perhaps you doe not expect, by saying, that I think there is a great deal of difference between the making a Volatile Salt of Tartar, and the making Salt of Tartar Volatile. For, though this seem to be but a Nicety, yet really it is none; and it is very possible, that a man may from Tartar obtain a Volatile salt,

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and yet be no wise able to volatilize that Tartareous Salt, that has been once by the incineration of the Tartar brought to fixt Alkaly. I have in the *Sceptical Chymist* summarily delivered a way, by which both I, and some Spagyrist that learned it of me, obtained from a mixture of Antimony, Nitre, and crude Tartar, a Volatil salt, which in probability comes from the last named of those three bodies; but experience carefully made has assured me, that without any additament, by a distillation warily and very slowly made, (inso-much that I have spent near a week in distilling one pound of matter) very clean Tartar, or at least the Crystals of Tartar, may, in conveniently shaped Vessels, be brought to afford a Substance that in Rectification will ascend to the upper part of the Vessel, in the form of a Volatil Salt, as if it were of Urine or of Harts-horne; of which (Tartareous) Salt, I keep some by me: But this operation requires not onely a dexterous,

terous, but a patient distiller.

But now as to the making a fixt Alkaly of Tartar become Volatil, I take it to be another, and have found it to be a far more difficult, work; the common Processes of performing it being wont to promise much more than they can make good; which I may justly say of some other, that private men have vaunted for great *Arcana*, but upon triall have satisfied me so little, that I have divers times offered pretenders to make Salt of Tartar Volatil, that without at all inquiring into their Processes, I would lay good wagers, that they could not doe what they pretended; not onely as divers Philosophical Spagyristes require, without any visible additament, but by any additament whatever; provided I were allowed to bring the Salt of Tartar my self, and to examine the Success, not by what may appear in the Alembic and Receiver, but by the weight of what would remain in the bottom. For I have convinced some of the more Ingenuous Ar-

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tists, that the Salt that sublimed was not indeed the Alkaly of Tartar, but somewhat that was by the operation produced, or rather extricated out of the additaments. But yet I would not be thought to affirm, that 'tis not possible to elevate the fixt Salt of Tartar. For sometimes I have been able to doe it, even at the first Distillation, by an artificial additament perhaps more fixt than it self; but, though the operation was very gratefull to me, as it shewed the Possibility of the thing, yet the paucity of the Salt sublimed and other Circumstances, kept me from much valuing it upon any other account. And there are other wayes, whereby Experience has assured me, that Salt of Tartar may be raised. And if one of them were not so uncertain, that I can never promise before hand that it will at all succeed, and the other so laborious, difficult and costly, that few would attempt or be able to practice it, I should think them very valuable things; since by the former,

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mer way most part of the Salt of Tartar was quickly brought over in the form of a Liquor, whose piercing smell was scarce tolerable; and by the latter way some Salt of Tartar of my own, being put into a Retort, and urged but with such a fire as could be given in a portable Sand-furnace, there remained not at the bottom near one half of the first weight, the additament having carried up the rest, partly in the form of a Liquor, but chiefly in that of a white Sublimate, which was neither ill-sented, nor in taste corrosive, or alcalizat, but very mild, and somewhat sweetish. And I doe not much doubt, but that by other wayes the fixt Alkaly of Tartar may be elevated, especially if, before it be exposed to the last operation of the fire, it be dextrously freed from the most of those Earthy and Viscous parts, that I think may be justly suspected to clog and bind the truly saline ones.

But I have too long digrest, and therefore shall intimate onely upon

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the by, that even the spurious *sal*
Tartari volatilized that is made with
Spirit of Vinegar, may, if it be well
prepared, make amends for its Emphy-
reumatical smell and tast, and may,
notwithstanding them, in divers ca-
ses be of no despicable use, both as a
Medicine, and a Menstruum.

CHAP. VI.

BEfore I draw towards a Conclu-
sion of these Notes about Vo-
latility, perhaps it will not be amiss,
to take notice of a Phænomenon,
which may much surprise, and some-
times disappoint those that deal in
Sublimations, unless they be fore-
warned of it. For though it be taken
for granted, and for the most part
may justly be so, that by carefully
mingling what is sublimed with what
remains, and re-subliming the mix-
ture, a greater quantity of the bo-
dy to be sublimed may be elevated
the second time than was the first,
and

and Production of Volatility. 41

and the third time than the second, and so onwards; yet I have not found this Rule alwayes to hold, but in some Bodies, as particularly in some kinds of dulcified Colcothar, the Sal Armoniac, would at the first Sublimation carry up more of the fixed powder, than at the second or third. So that I was by several Tryalls perswaded, when I found a very well and highly coloured powder elevated, to lay it by for use, and thereby save my self the labour of a prosecution, that would not onely have proved useless, but prejudicial. And if I misremember not, by often repeated Cohobations, (if I may so call them) of Sal Armoniac upon crude or Mineral Antimony, though the Sublimate that was obtained by the first Operation, was much of it variously, and in some places richly, coloured; yet afterwards, the Salt ascended from time to time paler and paler, leaving the Antimony behind it. Which way of making some Minerals more fixt and fusible I conceive

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ceive may be of great use in some Medicinal Preparations, though I think it not fit to particularize them in this place : Where my chief intent was, to mention the Phænomenon it self, and invite you to consider, whether it may be ascribed to this, that by the reiterated action of the fire, and grinding together of the body to be raised, either the corpuscles of the Sal Armoniac, or those of the other body, may have those little hooked or equivalent particles, whereby they take hold of one another, broken or worn off; and whether the indisposedness of the Colcotharine or Antimonial parts to ascend, may not in some cases be promoted by their having, by frequent attritions, so smoothed their Surfaces that divers of them may closely adhere, like pieces of polished Glass, and so make up Clusters too unweildy to be so raised, as the single corpuscles they consist of, were. Which change may dispose them to be at once less Volatil and more Fusible. Which
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and Production of Volatility. 43

Conjectures I mention to excite you to frame better, or at least to make amends for my omission of examining these, by trying whether the Sal Armoniac grown white again will be as fit as it was at first to carry up fresh bodies; and also by observing the weight of the unelevated part, and employing those other wayes of *examen*, which I should have done, if I had not then made Sublimations for another end, than to clear up the Doctrine of Volatility.

And here it may be profitable to some Chymists, though not necessary to my Subject, to intimate, that Sublimations may be useful to make very fine Commixtions of divers bodies. That those that are elevated are reduced to a great fineness of parts, is obvious to be observed in many Examples, whence it has been anciently, not absurdly, said, that Sublimations are the Chymists Pestles, since (as in Flowers of Sulphur and Antimony) they do really resolve the eleva-

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elevated bodies into exceeding fine
Flower, and much finer than Pestles
and Mortars are wont to bring them
to. But that which I intend in this
Paragraph is not a thing so obvious,
since 'tis to observe, that sometimes
even bodies so fixt as not at all to a-
scend in Sublimation, may yet be re-
duced by that operation into pow-
ders extreamly fine. For exemplify-
ing of which, I shall put you in mind,
that though Spagyristes complain much
of the Difficulty of making a good
Calx of Gold, and of the Imperfe-
ction of the few ordinary processes
prescribed to make it, (which would
be more complained of, but that
Chymical Physicians seldom attempt
to prepare it,) yet we are informed by
triall, that by exactly grinding a thick
amalgam of Gold and Mercury with a
competent weight, (at least equal to
its own) of finely powdered Sulphur,
we may, by putting the mixture to su-
blime in a conveniently shaped Glass,
by degrees of fire obtain a Cinaber
that will leave behind it a finer Calx
of

and Production of Volatility. 45
of Gold than will be had by some far
more difficult processes.

But 'tis now time to draw towards
a Conclusion of our Notes about Vo-
latility; which Quality depends so
much upon the contexture of the
corpuscles that are to be raised to-
gether, that even very ponderous
bodies may serve for volatilizing ad-
ditaments, if they be disposed to fa-
sten themselves sufficiently to the bo-
dies they are to carry up along with
them. For, though *Lead* be, save
one, the heaviest solid we know
of, and though *Quick-silver* be the
heaviest body in the world, except
Gold; yet trialls have assured us,
that *Quick-silver* it self being united
by Amalgamation with a small pro-
portion of *Lead*, will by a fire that
is none of the violentest, and in close
Vessels, be made to carry over with it
some of the *Lead*. As we clearly found
by the increased weight of the *Quick-*
silver that passed into the Receiver;
which, by the way, may make us
cautious how we conclude *Quick-*
silver

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silver to be pure, meerly from its having been distilled over.

There remains but one body more heavy than those I come from naming, and that is *Gold*; which, being also of a fixity so great that 'tis indeed admirable, I doe not wonder that not onely the more wary Naturalists, but the more severe among the Chymists themselves should think it incapable of being volatilized. But yet, if we consider, how very minute parts Gold may be rationally supposed to consist of, and to be divisible into, me thinks it should not seem impossible, that, if men could light on Volatil Salts endowed with figures fit to stick fast to the corpuscles of the Gold, they would carry up with them bodies, whose solidity can scarce be more extraordinary than their minuteness is: And in effect, we have made more than one *Menstruum*, with which some particles of Gold may be carried up. But when I employed that which I recommended to you formerly under the
name

and Production of Volatility. 47

name of *Menstruum peracutum* (which consists mainly, and sometimes onely, of Spirit of Nitre, several times drawn from Butter of Antimony,) I was able, without a very violent fire, in a few hours to elevate so much crude Gold, as, in the neck of the Retort, afforded me a considerable Quantity of Sublimate, which I have had red as blood, and whose consisting partly of Gold manifestly appeared by this, that I was able with ease to reduce that metall out of it.

In reckoning up the Instruments of Volatilization, we must not quite leave out the mention of the *Air*, which I have often observed to facilitate the elevation of some bodies even in close Vessels; wherein, though to fill them too full be judged by many a Compendious practise, because the steams have a less way to ascend, yet Experience has several times informed me, that, at least in some cases, they take wrong measures, and that (to pass by another Cause of their disappointment) a large proportion

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tion of Air, purposely left in the Vessels, may more than compensate the greater space that is to be ascended by the vapours or exhalations of the matter that is to be distilled or sublimed. And if, in close Vessels, the presence of the Air may promote the ascension of bodies, it may well be expected, that the elevation of divers of them may be furthered by being attempted in open Vessels, to which the Air has free access. And if we may give any credit to the probable Relations of some Chymists, the Air does much contribute to the volatilization of some bodies that are barely, though indeed for no short time, exposed to it. But the account on which the Air by its bare presence or peculiar operations conduces to the Volatilization of some bodies, is a thing very difficult to be determined, without having recourse to some Notions about Gravity and Levity, and of the Constitution of the corpuscles that compose the Air; which I take to be both very numerous and
no

and Production of Volatility. 49

no less various. And therefore I must not in these occasional Notes lanch out into such a Subject, though, for fear I should be blamed for too much slighting my old acquaintance the *Air*, I durst not quite omit the power it has to dispose some bodies to Volatility.

A moderate attention may suffice to make it be discerned, that in what hath been hitherto delivered, I have for the most part considered the small portions of matter, to be elevated in Volatilization, as intire Corpuscles: And therefore it may be now pertinent, to intimate in a Line or two, that there may be also Cases, wherein a kind of Volatilization, improperly so called, may be effected, by making use of such additaments as break off or otherwise divide the particles of the corpuscles to be elevated, and by adhering to, and so clogging, one of the particles to which it proves more congruous, inable the other, which is now brought to be more light or disingaged, to ascend. This
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may be illustrated by what happens,
when Sal Armoniac is well ground
with *Lapis Calaminaris* or with some
fix'd Alkali, and then committed to
distillation : For the Sea-salt , that
enters the Composition of the Sal
Armoniac , being detained by the
stone or the Alkali, there is a divorce
made between the common Salt and
the urinous and fuliginous Salts, that
were incorporated with it, and being
now disingaged from it, are easily e-
levated. I elsewhere mention, that
I have observed in Man's Urine a
kind of native Sal Armoniac, much
less Volatile than the fugitive that is
sublim'd from Man's Blood, Hartshorn, &c. and therefore supposing,
that a separation of parts may be
made by an Alkali, as well in this Salt
as in the common factitious Sal Ar-
moniac , I put to fresh Urine a con-
venient proportion (which was a
plentifull one) of Salt of Pot-ashes
(that being then at hand) and distil-
ling the Liquor , it yielded, accor-
ding to expectation, a Spirit more Vo-
latile

latile than the Phlegm, and of a very piercing tast ; which way of obtaining a Spirit without any violence of fire, and without either previously abstracting the Phlegm, (as we are fain to do in fresh Urine) or tediously waiting for the fermentation of stale Urine, I taught some Chymists, because of the usefulness of Spirit of Urine ; which being obtained this innocent way, would probably be employed with much less suspicion of corrosiveness, than if in the operation I had made use of Quick-lime. Another Illustration of what I was not long since saying, may be fetch'd from the Experiment of making Spirit of Nitre by mixing Salt-peter with Oil of Vitriol, and distilling them together : For the Oil does so divide or break the corpuscles of the Nitre, that the now-disposed particles of that Salt, which amount to a great portion of the whole, will be made easily enough to ascend even with a moderate fire of Sand, and sometimes without any

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fire at all, in the form of Spirits, exceeding unquiet, subtle, and apt to moak a way.

To which Instances of this imperfect kind of Volatilization more might be added, but that you may well think, I have detain'd you but too long already with indigested Notes about *one* Quality.

CHAP. VII.

THe last means of Volatilizing bodies is, the operation of the Fire or some other actual Heat : But of this, which is obvious, it would be superfluous to discourse. Onely this I shall intimate, that there may be bodies, which, in such degrees of fire as are wont to be given in the vulgar operations of Chymists, will not be elevated, which yet may be forced up by such violent and lasting fires, as are employed by the Melters of Ores, and Founders of Guns, and sometimes by Glass-makers. And on
this

this Consideration I shall here observe to you, since I did not doe it at my entrance on these Notes, that Chymists are wont to speak, and I have accordingly been led to treat, of Volatility and Fixity in a popular sense of those Terms. For if we would consider the matter more strictly, I presume we should find that Volatility and Fixity are but relative Qualities, which are to be estimated, especially the former of them, by the degree of fire to which the body, whereto we ascribe one or other of those Qualities, is exposed; and therefore it is much more difficult than men are aware of, to determine accurately, when a body ought to be accounted Volatile and when not; since there is no determinate degree of Heat agreed on, nor indeed easie to be devised, that may be as a standard, whereby to measure Volatility and Fixtness: And 'tis obvious, that a body, that remains fixt in one degree of fire, may be forced up by another. To which may be added,
agree-

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agreeably to what I lately began to observe, that a body may pass for absolutely fixt among the generality of Chymists, and yet be unable to persevere in the fires of Founders and Glass-makers: Which brings into my mind, that not having observed, that Chymists have examined the Fixity of other bodies than metalline ones by the Cupel, I had the Curiosity to put dry Salt of Tartar upon it, and found, as I expected, that in no long time it manifestly wasted in so vehement a heat, wherein also the Air came freely at it, (though Quick-lime, handled after the same way, lost not of its weight,) and having well mixed one ounce of good Salt of Tartar with treble its weight of Tobacco-pipe Clay, we kept them but for two, or at most three hours, in a strong fire; yet the Crucible being purposely left uncovered, we found the Salt of Tartar so wasted, that the remaining mixture (which was not flux'd) afforded us not near a quarter of an ounce of Salt. And indeed I
scarce

scarce doubt, but that in strictness divers of those bodies that pass for absolutely fixt, are but semi-fixt, or at least but comparatively and relatively fix'd, that is, in reference to such degrees of fire, as they are wont to be exposed to in the Distillations, Sublimations, &c. of Chymists; not such as are given in the raging fires of Founders, and Glass-makers. And perhaps even the fires of Glass-makers and Say-masters themselves are not the most intense that may possibly be made in a short time, provided there be but small portions of matter to be wrought on by them. And in effect, I know very few bodies, besides Gold, that will persevere totally fixt in the vehementest degrees of fire that Trials have made me acquainted with. And I elsewhere tell you, that, though Tin, in our Chymical Reverberatories themselves, is wont to be reduced but into a *Calx* that is reputed very fixt; yet in those intense fires, that a *Virtuoso* of my acquaintance uses in his Tin-Mines, there is
not

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not seldom found quantities of Tin
carried up to a notable height in the
form of a whitish powder, which,
being in good masses forced off from
the places to which it had fastened it
self, does by a skillful reduction yield
many a pound weight of good mal-
leable metal, which seemed to me to
be rather more, than less, fine than
ordinary Tin.

Postscript,

*Relating to Page 15. of this Tract; and
here annext for their sakes, who have
a mind to repeat the Experiment there
delivered, that so they may know the
quantities employed in it.*

With two parts of this Crocus we
ground very well three parts of Sal
Armoniac, and having sublimed them in a
strong fire, we took off the high coloured
Sublimat, and put in either an equal weight,
or a weight exceeding it by half, to the Caput
Mortuum, we found after the second Subli-
mation, which was also high coloured, that
of an ounce of Crocus we had raised six
drams, that is, three quarters of the whole
weight.

F I N I S.

